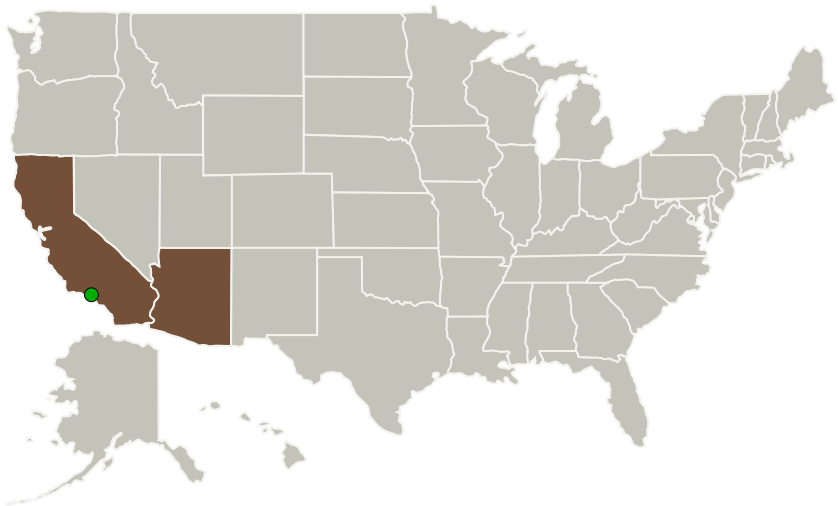
High Speed Digitizer for Remote Sensing, Phase II

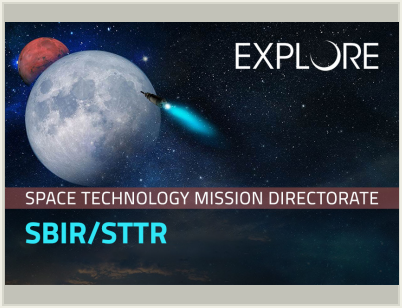
Completed Technology Project (2015 - 2019)

Project Introduction

This SBIR Phase II proposal requests support for Alphacore, Inc. to design and characterize a 24 Gsps (gigasamples per second), wide input bandwidth (40 GHz), 6-bit (5.0 effective number of bits, ENOB), low-power (700 mW), and low-cost analog-to-digital converter (ADC) for use in a wide range of NASA's microwave sensor remote sensing applications. The ADC does not employ time-interleaving and provides a very wide spur free input bandwidth making it more suitable to NASA's remote sensing missions and a variety of radio astronomy applications than any other ADC available. In addition, the ADC will be radiation hard (>300krad) and thus suitable for use on-board space missions. A key innovation in Alphacore's approach to the ADC design is that we have considered how the ADC will be used in a system; a custom designed digital back-end implements digital data de-multiplexing and signal conditioning to allow seamless integration with commercially available, high-end, field programmable gate arrays (FPGA) that are the main building blocks of modern scientific spectrometers and interferometers. Alphacore's ADC provides these improvements at much lower power and lower cost than existing commercial ADCs that use off-chip components to provide these features. Alphacore's design takes advantage of the latest low-power, high-speed digital CMOS processes, resulting in ADC power consumption that is less than 1/8 of the power consumption of competitor ADCs. The proposed ADC employs an innovative topology with high-bandwidth front-end sampling circuit combined with an interpolated flash-type ADC and encoder circuitry that simplifies FPGA interfacing. All the needed clock signals are generated from a low-cost 100MHz crystal clock reference with a low-jitter (<200fs), radiation-tolerant on-chip PLL.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Alphacore, Inc.	Lead Organization	Industry	Tempe, Arizona
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
Arizona	California

Images

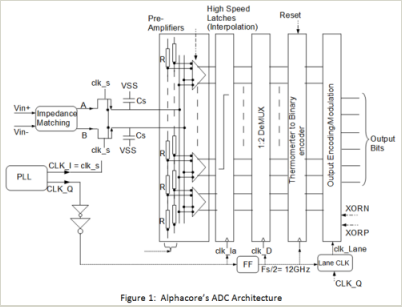

Figure 1: Alphacore's ADC Architecture

Briefing Chart
High Speed Digitizer for Remote Sensing Briefing Chart *(https://techport.nasa.gov/image/127938)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Alphacore, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Esko Mikkola

Co-Investigator:
Esko O Mikkola

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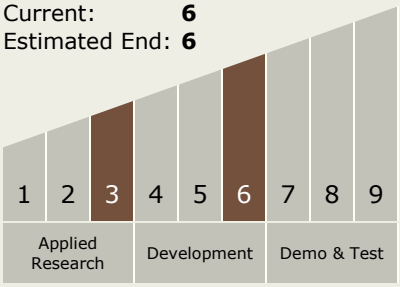
Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.2 Avionics Systems and Subsystems
    - TX02.2.6 Data Acquisition Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System